use the same argument that "heterozygous individuals sometimes show the recessive character," we might, if necessary, use the same argument to prove the dominance of cataract. On the assumption that congenital cataract is dominant instead of recessive it might be maintained that in those cases where both parents of affected individuals seem to be normal, one of them is, after all, heterozygous—and affected children are therefore to be expected (p. 444).

Perhaps Danforth would be willing to consider another explanation which he suggests, that somatic cataracts of a congenital origin are not uncommon. If one of the parents in question had a somatic cataract the appearance of normal children would be expected but not of affected children unless the parent was also heterozygous for hereditary cataract. A probability which would be rather remote but not impossible.

From the data as they have been gathered up to this time it seems impossible to arrive at an explanation of the mode of inheritance of cataract which will be entirely satisfactory. While more proof is awaited, we believe that the assumption of congenital cataract as a single, recessive, unit character has the best support from the facts at hand. The article by Danforth has brought out several important considerations which we neglected. It is regretted that in this paper which at first sight makes out a strong case against our recessive hypothesis there is nothing offered towards a different solution of the problem.

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THE STATUS OF FOWLER'S TOAD, *BUFO FOWLERI* PUTNAM

S. P. FOWLER, of Danvers, Essex County, Massachusetts, appears to have been the first to recognize the fact that this toad differed in many respects from the common toad. In a letter[1] to Prof. F. W. Putnam, Fowler gave a very accurate and complete account of the song and habits of this toad as he had observed it around Danvers.

Cope (see loc. cit.) discussed in much detail *Bufo lentiginosus fowleri* (Putnam). Little was known of this toad at the time Cope wrote. In fact, Cope stated that it was confined to a few

[1] Cope, E. D., "The Batrachia of North America," Bull. 34, U. S. National Museum, 1889, pp. 279–281.

ponds in northeastern Massachusetts, near the town of Danvers. He says:

> Such a limited distribution for a land vertebrate is remarkable, as is also the fact of its having so long remained without introduction to science.

Cope's work was published in 1889, in the same year that Allen[2] reports having heard Fowler's toad in New Hampshire. Speaking of *Bufo americanus* Le Conte, Allen said:

> After the breeding season, the toad's song changes from a prolonged pipe to a shorter, lower-toned note, that, at night, has a peculiar weirdness, and almost reaches a wail.

Although Allen thought that the common toad was responsible for the two songs, it is plain that he had heard the unmistakable song of Fowler's toad. Allen's observation extended the range of this toad well up into New Hampshire.

Although as late as 1889 Fowler's toad appeared to have a very local distribution in New England, more recent work has shown that this toad has an extended range southward.

In 1907 the writer[3] published a paper showing that Fowler's toad is very common around Oxford and Worcester, in Worcester County, Massachusetts. In a second paper, published in 1908,[4] it was shown that the range of this toad extended through Washington, D. C., and Chapel Hill, North Carolina, into northern Georgia, where it appeared to be the only common form in the vicinity of Hoschton and Thompson's Mills, near Gainesville.

In 1910 Miller and Chapin[5] gave an excellent discussion of the range of *Bufo americanus* and *Bufo fowleri* in New Jersey and adjacent regions of New York.

From the observations of Miller and Chapin it appears that Fowler's toad occupies practically the entire state of New Jersey, except, perhaps, the extreme northwestern part. Throughout

[2] Allen, Glover M., "Notes on the Reptiles and Amphibians of Intervale, New Hampshire," *Proc. of the Boston Society of Nat. History*, Vol. 29, No. 3, 1889, p. 71.

[3] Allard, H. A., "Fowler's Toad, *Bufo fowleri* Putnam," *Science*, N. S., Vol. 26, No. 664, Sept. 20, 1907, pp. 383–384.

[4] Allard, H. A., "*Bufo fowleri* in Northern Georgia," *Science*, N. S., Vol. 28, No. 723, Nov. 6, 1908, pp. 655–656.

[5] Miller, W. De W., and Chapin, James, "The Toads of the Northeastern United States," *Science*, N. S., Vol. 32, No. 818, Sept. 2, 1910, pp. 315–317.

central and southern New Jersey it is the only species, as *B. americanus* was not found here. Miller and Chapin also found that Fowler's toad was the only form to be found upon Staten Island, N. Y., as well as upon Long Island. In the mountainous parts of northern New Jersey both *B. americanus* and *B. fowleri* occur.

In 1914 Overton[6] published an interesting paper concerning the frogs and toads of Long Island. Overton found that *Bufo fowleri* is the only toad occurring on Long Island, where it appears to be common, while the common toad of the mainland of New York State is *B. americanus*.

Various authors have mentioned the song of *Bufo fowleri*. S. P. Fowler in the letter to Professor S. W. Putnam, previously cited, first described its song. His description is particularly apt.

> To my ears the croak is a sharp, disagreeable, unearthly screech, difficult to describe, as it is unlike any sound I have ever heard. A chorus of these has been likened to the whoop of a party of Indians.

As none of us at this late day can recall the whoop of Indians, this comparison, although historically interesting, does not give us much aid in appreciating the peculiar nature of the sound.

Dr. Nichols, in the same letter, is cited as considering the song to be a shrill monotone in a high falsetto voice, longer and more trilling than the voice of Pickering's *hyla*. Fowler, however, states that there is no trill to the note, an opinion the writer also shares.

The writer has described the note as follows: "I have heard nothing in nature so weird and unearthly as the almost agonized wail of this toad, repeated at intervals,"[7] and "The usual note of Fowler's toad is a brief, penetrating, droning scream."[8]

Miller and Chapin, in their article previously cited, say of it:

> . . . it certainly has much less music to it than the trill of the American toad. The notes are more closely connected, so that a sort of buzzing is heard.

Miss Dickerson[9] says of the notes of *Bufo fowleri:*

[6] Overton, Frank, "The Frogs and Toads," Long Island Fauna and Flora, III. In the Museum of the Brooklyn Institute of Arts and Sciences, *Science Bulletin*, Vol. 2, No. 3, Nov. 3, 1914.

[7] *Science*, N. S., Vol. 26, No. 664, Sept. 20, 1907.

[8] *Science*, N. S., Vol. 28, No. 723, Nov. 6, 1908.

[9] Dickerson, Mary C., "The Frog Book," 1906.

The call of the Fowler's toad is a metallic, droning sound, not conspicuously vibrated. The pitch of the call may be as high as that of *Bufo americanus,* but descends in doleful fashion through several intervals before the close. Its carrying power is unusually great. The quality is indescribable; on the whole, the call is weird and mournful and not especially agreeable to our ears.

Overton (previously cited) says:

Its song is a combination of a low whistle and a moan, and the two sounds do not melt into a chord. The combined sound is discordant and decidedly unpleasant to a musical ear, but at a distance the sound is more pleasant for the moan is not apparent and only the whistle is heard. The sound lasts from two to three seconds and may be repeated at intervals of about ten seconds.

Overton says the song of *Bufo americanus* is prolonged about thirty seconds.

Dr. Andrew Nichols,[10] of Danvers, Massachusetts, is quoted as saying:

There is no sound in bog, pond, fen, forest, or air at all like it.

Although Nichols referred to the toad as *Bufo lentiginosus* Shaw, it is extremely probable that he had in mind *Bufo fowleri.*

Miss Hinckley[11] says:

The bleat of *B. fowleri,* with its far reaching, metallic ring, is usually heard after sunset. I have seen the latter give voice on the land, while the trill of *B. americanus,* heard at all times of day and night during the mating season, I have only seen given in the water.

In the field the writer has found little difficulty in recognizing Fowler's toad throughout its range. Its note at once distinguishes it from *B. americanus.* Color characters, while fairly definite, do not, perhaps, always serve to distinguish *B. fowleri* from *B. americanus.* According to Miller and Chapin, the color of the eye alone will distinguish *B. fowleri* from *B. americanus.* These observers state that in the former the iris is silvery, while in the latter it is bronze. There is some question in the writer's mind as to the value of this character as an identification mark. The question is now under investigation.

[10] Nichols, Andrew, *Proc. of the Boston Soc. of Nat. History,* Vol. 1, Aug. 2, 1843, p. 136.

[11] Hinckley, Mary C., "On Some Differences in the Mouth Structure of Tadpoles of the Anourous Batrachians Found in Milton, Mass.," *Proc. of the Boston Soc. of Nat. Hist.,* Vol. 21, 1882, pp. 307–314.

Miss Dickerson states that the eggs of *Bufo fowleri* are often arranged in double rows, but that, so far as known, the eggs of *B. americanus* are always laid in single strings. If these characteristics hold true for the two toads it would appear that the toad with which Gage[12] worked was *Bufo fowleri,* rather than *Bufo lentiginosus americanus.* Speaking of the toads with which he worked, Gage states that they lay their eggs from the middle of April until the middle of June, and that the eggs were laid in two strings, one from each oviduct. The lateness of the egg-laying season adds to the probability that Gage worked with *B. fowleri* rather than with *B. americanus.*

From the observations of various observers, it is evident that *Bufo fowleri* is a widely distributed toad and is extremely abundant in many places from New Hampshire, throughout New Jersey, the District of Columbia, southward at least as far as Gwinnett, Jackson and Hall Counties in northern Georgia. Cope (previously cited) records a specimen of this toad from New Harmony, Posey County, Indiana. He also states that a specimen of the variety *B. lentiginosus* var. *americanus* from Nebraska approximates so nearly *B. fowleri,* that the latter can not be regarded as under all circumstances separate and specific in its rank.

Miller and Chapin have found that toads taken on the Palisades and on the northern end of Manhattan Island sometimes show forms intermediate between *B. americanus* and *B. fowleri.* These observers have suggested that such intermediate forms may represent hybrids, but, as they state, it is a question for experimental study.

For a long time the writer has had in mind the question of experimental hybridization between typical forms of *B. fowleri* and *B. americanus.* It would be of considerable interest to determine whether or not these two toads can be hybridized. Although *B. fowleri* is more sensitive to lower temperatures than *B. americanus,* and lays its eggs later in the season, it should not be especially difficult to provide conditions that would bring the mating season of the two toads together under temperature conditions required by *B. fowleri.* It is very probable that the hibernation period of *B. americanus* could be prolonged by artificial refrigeration until the mating and egg-laying period of *B.*

[12] Gage, S. H., "Hibernation, Transformation and Growth of the Common Toad (*Bufo lentiginosus americanus*)," Ithaca, N. Y., *Proc. of Amer. Assoc. for the Advancement of Science,* 47: 1898.

fowleri had arrived. If experimental hybrids could be obtained, it would be especially interesting to compare the voices of the hybrids with the voices of the parents, as well as to determine the hereditary behavior of various other characters.

In those localities where both toads are found, differences in behavior peculiar to each species tend to prevent natural cross mating. *Bufo americanus* is the first toad to appear and, at least around Oxford, Massachusetts, has completed egg-laying and left the water long before *B. fowleri* has appeared. Furthermore, the preference that *B. fowleri* shows for certain ponds from year to year is rather remarkable.

Fowler (letter previously cited) noted that only certain ponds around Danvers, Massachusetts, were visited by *B. fowleri.* In the region of the writer's early home, Oxford, Massachusetts, the same rigid preference was shown for certain bodies of water during the mating season. Here it was indicated that these toads traveled very long distances to reach a certain quiet bend in the Maanixit River. Although other permanent bodies of water were near, these, for some reason, were never visited by these toads.

The writer hopes that an interest in our common toads will finally lead some one to investigate the possibility of experimental hybridization between *B. americanus* and *B. fowleri,* and the question of the relationship of these toads. Batrachian hybridization seems never to have been undertaken. It would appear that such investigations would throw much light on the question of geographic variation, intergrading forms, etc. Few creatures are more companionable and harmless in their behavior and more useful to the agriculturist as insect destroyers, than the toads. Knowledge of their habits, relationship, etc., is not only of scientific, but also of soundly practical interest.

ADDITIONAL REFERENCES IN THE LITERATURE TO FOWLER'S TOAD

Holbrook, J. E. *North American Herpetology,* Vol. 5, 1842. Speaking of *Bufo lentiginosus* Shaw, he says the males seek the females in the month of May when hundreds may be seen together in some stagnant pool depositing their eggs. Of the notes he says: "The males at this season are extremely noisy, though at other times they are silent, or make only a slight chirp when taken" (p. 9).

Gorman, Samuel. The North American Reptiles and Batrachians. *Bull. Essex Inst.,* Vol. 16, 1884. On page 42 he says of *B. fowleri* Putnam: "This is an *americanus* of moderate size and with frontal ridges low,

close together, and nearly or quite parallel. Voice peculiar. Manitoba to Winnipeg; Massachusetts.''

Cope, E. D. Check List of North American Batrachia and Reptilia with a Systematic List of the Higher Groups and an Essay on Geographical Distribution based on the Specimens contained in the U. S. Nat. Museum. 1875. P. 29, *B. lentiginosus,* subspecies *fowleri* is given a distribution from Massachusetts to Lake Winnipeg. Lists *B. l. fowleri* (page 86) as confined mostly to the Canadian District of the Eastern Region.

Hay, O. P. The Batrachians and Reptiles of Indiana, 17th Ann. Rept. of Dept. of Geol. and Nat. Resources of Indiana, 1891. *B. fowleri* considered a variety of *B. lentiginosus.* Range given as Danvers, Mass., and the fact that Cope reported a specimen from New Harmony, Indiana (p. 459).

Sherwood, W. L. The Frogs and Toads Found in the Vicinity of New York City. Abst. No. 10 of the Proc. of the Linn. Soc. of N. Y. for year ending 1898. Mentions *B. fowleri* as a subspecies of the common toad, stating that it was confined to northeastern Massachusetts.

Jordan, David Starr. A Manual of the Vertebrate Animals of the Northern United States. 1899. On page 182, *B. fowleri* is mentioned as a variety of *B. lentiginosus.*

Ditmars, Raymond L. The Batrachians of the Vicinity of New York City. *The American Museum Journal,* Vol. 5, 1905. Speaking of the common toad, he says there are four varieties, one of which occurs only in northeastern Massachusetts.

Fowler, H. W. A Supplementary Account of New Jersey Amphibians and Reptiles. Rept. of New Jersey State Museum, Part III, 1911. *Bufo fowleri* is mentioned.

Hancock, J. L. The Toad's Social Life in Nature. Sketches in Temperate America, 1911. Fowler's toad is briefly mentioned and illustrations are shown.

Surface, H. A. First Report on the Economic Features of the Amphibians of Pennsylvania. Zoological Bulletin of the Div. of Zoology, Pennsylvania Dept. of Agriculture, Vol. III, Nos. 3 and 4, May–July, 1913. On page 114, *B. fowleri* is discussed. Statement made that it has been recorded from New England and New York.

H. A. ALLARD

WASHINGTON, D. C.,
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